DOCTOR
OF
PHILOSOPHY

THE ROLE OF CLOUD-TOP ENTRAINMENT IN COASTAL STRATOCUMULUS TOPPED BOUNDARY LAYERS
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Several issues associated with vertical grid resolution and the turbulence parameterization in mesoscale models are addressed in this study. Of particular concern is the issue of cloud top entrainment, the entrainment fluxes, and the impact entrainment has on boundary layer development and inversion strength. These issues are studied through careful analysis of in situ data and mesoscale simulations. In this study, observations are analyzed to better understand the evolution of the marine boundary layer in various environmental conditions. The capability of the U.S. Navy's current Coupled Ocean-atmosphere Mesoscale Prediction System (COAMPS^{TM}) is then explored, using real case studies of summertime conditions along the California coast. The model's ability to accurately represent the boundary layer turbulence mixing at vertical resolutions feasible for operational prediction is analyzed. Based on results from the above analysis, the existing parameterizations are modified towards more realistic representations of the cloud top processes and these modifications are shown to improve COAMPS^{TM} predictions in this regime.

KEYWORDS: Entrainment, Cloud-topped Marine Boundary Layer, Mesoscale Modeling, COAMPS

VALIDATING COMPUTATIONAL HUMAN BEHAVIOR MODELS: CONSISTENTCY AND ACCURACY ISSUES
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As leaders of the Department of Defense (DoD) rely more on modeling and simulation (M&S) to provide information on which they base strategic and tactical decisions, the credibility of simulations becomes more important. This credibility is initially gained through the verification, validation, and accreditation process DoD models are required to undergo prior to their use in simulations. The process of validating behavioral models is not well defined, nor is the process extendable to meet requirements for validating the varied and complex behavioral models. Through a series of empirical studies, this research identifies subject matter expert (SME) biases and their effects on consistency and accuracy of results. This research concludes that a SME's bias has a statistically significant effect on subjective assessment of human performance of urban

combat skills. To this end, the research demonstrates how the effects of the natural biases of SMEs can be mitigated based on the scale used to assess human behavior representation (HBR) models, providing a more consistent and accurate means of validating HBR models. In doing so, it assists the DoD M&S community by providing enhancements to validation procedures for assessing HBR model implementations for future use in DoD legacy and developmental combat models.

KEYWORDS: Validation, Cognitive Model, Modeling and Simulations, Human Behavior Representation, Bias, Multi Agent Systems, Behavioral Psychology, Cognitive Psychology, VV&A, Human Performance Evaluation

PERFORMANCE OF COHERENT AND NONCOHERENT RAKE RECEIVERS WITH CONVOLUTIONAL CODING, RICEAN FADING, AND PULSE-NOISE INTERFERENCE
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The performance of coherent and non-coherent RAKE receivers over a fading channel in the presence of pulse-noise jamming and additive white Gaussian noise is analyzed. Coherent RAKE receivers require a pilot tone for coherent demodulation. Using a first order phase-lock-loop to recover a pilot tone with additive white Gaussian noise causes phase distortions at the phase-lock-loop output, which produce an irreducible phase noise error floor for soft decision decoding. Both coherent and non-coherent RAKE receivers optimized for additive white Gaussian noise perform poorly when pulse-noise jamming is present. When soft decision convolutional coding is considered, the performance degrades as the duty cycle of the pulse-noise jamming signal decreases. The reverse is true for hard decision decoding, since fewer bits are jammed and bit errors with high noise variance cannot dominate the decision statistics. A soft decision RAKE receiver optimized for pulse-noise jamming and additive white Gaussian noise performed the best for both the coherent and non-coherent RAKE receivers. This receiver scales the received signal by the inverse of the variance on a bit-by-bit basis to minimize the effect of pulse-noise jamming. The efficacy is demonstrated by analytical results, revealing that this receiver reduces the probability of bit error down to the irreducible phase noise error floor when pulse-noise jamming is present. This demonstrates how important it is to design the receiver for the intended operational environment.

KEYWORDS: RAKE, Noncoherent RAKE, Interference, Pulse-noise, Phase Noise, Coding